Systèmes de coordonnées



	Cartésiennes	Cylindriques	Sphériques
DEFINITIONS	$U = U(x, y, z)$ $\mathbf{A} = A_x\mathbf{e}_x + A_y\mathbf{e}_y + A_z\mathbf{e}_z$ $A_x = A_x(x, y, z)$ $A_y = A_y(x, y, z)$ $A_z = A_z(x, y, z)$	$U = U(\rho, \varphi, z)$ $\mathbf{A} = A_\rho\mathbf{e}_\rho + A_\varphi\mathbf{e}_\varphi + A_z\mathbf{e}_z$ $A_\rho = A_x \cos\varphi + A_y \sin\varphi$ $A_\varphi = -A_x \sin\varphi + A_y \cos\varphi$	$U = U(r, \theta, \varphi)$ $\mathbf{A} = A_r\mathbf{e}_r + A_\theta\mathbf{e}_\theta + A_\varphi\mathbf{e}_\varphi$ $A_r = A_\rho \sin\theta + A_z \cos\theta$ $A_\theta = A_\rho \cos\theta - A_z \sin\theta$ $A_\varphi = -A_x \sin\varphi + A_y \cos\varphi$
GRADIENT	$\nabla U = (\partial U/\partial x)\mathbf{e}_x$ $+ (\partial U/\partial y)\mathbf{e}_y$ $+ (\partial U/\partial z)\mathbf{e}_z$	$(\nabla U)_\rho = \partial U/\partial\rho$ $(\nabla U)_\varphi = [\partial U/\partial\varphi]/\rho$ $(\nabla U)_z = \partial U/\partial z$	$(\nabla U)_r = \partial U/\partial r$ $(\nabla U)_\theta = [\partial U/\partial\theta]/r$ $(\nabla U)_\varphi = [\partial U/\partial\varphi]/(r \sin\theta)$
LAPLACIEN	$\Delta U = \frac{\partial^2 U}{\partial x^2} + \frac{\partial^2 U}{\partial y^2} + \frac{\partial^2 U}{\partial z^2}$	$\Delta U = \frac{1}{\rho}\frac{\partial}{\partial\rho}\left(\rho\frac{\partial U}{\partial\rho}\right) + \frac{1}{\rho^2}\frac{\partial^2 U}{\partial\varphi^2} + \frac{\partial^2 U}{\partial z^2}$	$\Delta U = \frac{1}{r}\frac{\partial^2}{\partial r^2}(rU) + \frac{1}{r^2 \sin\theta}\frac{\partial}{\partial\theta}\left(\sin\theta\frac{\partial U}{\partial\theta}\right) + \frac{1}{r^2 \sin^2\theta}\frac{\partial^2 U}{\partial\varphi^2}$
DIVERGENCE	$\nabla \cdot \mathbf{A} = \frac{\partial A_x}{\partial x} + \frac{\partial A_y}{\partial y} + \frac{\partial A_z}{\partial z}$	$\nabla \cdot \mathbf{A} = \frac{1}{\rho}\frac{\partial}{\partial\rho}(\rho A_\rho) + \frac{1}{\rho}\frac{\partial A_\varphi}{\partial\varphi} + \frac{\partial A_z}{\partial z}$	$\nabla \cdot \mathbf{A} = \frac{1}{r^2}\frac{\partial}{\partial r}(r^2 A_r) + \frac{1}{r \sin\theta}\frac{\partial}{\partial\theta}(\sin\theta A_\theta) + \frac{1}{r \sin\theta}\frac{\partial A_\varphi}{\partial\varphi}$
ROTATIONNEL	$\nabla \wedge \mathbf{A} = (\partial A_z/\partial y - \partial A_y/\partial z)\mathbf{e}_x$ $+ (\partial A_x/\partial z - \partial A_z/\partial x)\mathbf{e}_y$ $+ (\partial A_y/\partial x - \partial A_x/\partial y)\mathbf{e}_z$	$(\nabla \times \mathbf{A})_\rho = (\partial A_z/\partial\varphi)/\rho - \partial A_\varphi/\partial z$ $(\nabla \times \mathbf{A})_\varphi = \partial A_\rho/\partial z - \partial A_z/\partial\rho$ $(\nabla \times \mathbf{A})_z = [\partial(\rho A_\varphi)/\partial\rho - \partial A_\rho/\partial\varphi]/\rho$	$(\nabla \times \mathbf{A})_r = [\partial(\sin\theta A_\varphi)/\partial\theta - \partial A_\theta/\partial\varphi]/(r \sin\theta)$ $(\nabla \times \mathbf{A})_\theta = [\partial A_r/\partial\varphi - \sin\theta\, \partial(r A_\varphi)/\partial r]/(r \sin\theta)$ $(\nabla \times \mathbf{A})_\varphi = [\partial(r A_\theta)/\partial r - \partial A_r/\partial\theta]/r$